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(54) Method for transferring mould-carrying wagons in a bending furnace for glass sheets and bending furnace

(57) The invention relates to a method for transferring mould-carrying wagons in a bending furnace for glass sheets as well as to a bending furnace for glass sheets, comprising preheating stations (1.3, 1.4, 1.5) and more than two bending stations (2.1, 2.2, 2.3, 2.4) in succession and therebelow a number of cooling stations (3.1, 3.2, 3.3, 3.4), a first number of mould-carrying wagons (3, 4) on an upper track (1) and a second number of mould-carrying wagons (3, 4) on a lower

track (2), an end wall (4) of the mould-carrying wagons defining said preheating, bending and cooling stations when the mould-carrying wagons (3, 4) are stationary. After a bending, the mould-carrying wagon (3, 4) is transferred under one or more bending stations (2.3, 2.2) to a location directly below the first bending station (2.1) or the final preheating station (1.5).

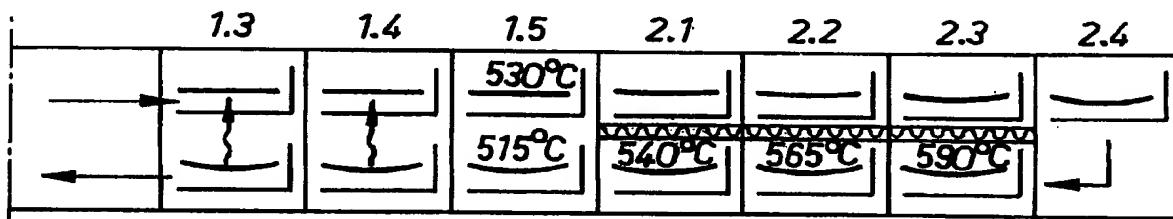


Fig. 1 (PRIOR ART)

Description

The present invention relates to a bending furnace for glass sheets, comprising preheating stations and more than two bending stations in succession and therbelow a number of cooling stations, a first number of mould-carrying wagons on an upper track and a second number of mould-carrying wagons on a lower track, an end wall of the mould-carrying wagons defining said preheating, bending and cooling stations when the mould-carrying wagons are stationary. The invention relates also to a method for transferring mould-carrying wagons in this type of bending furnace.

Such a bending furnace is prior known from Patent publication US 4,497,645. The furnace has proved highly useful and energy efficient since the heat of glass sheets cooling on the lower track can be exploited for the heating of glass sheets to be heated on the upper track. In this type of furnace, the production capacity or output can be increased by increasing the number of successive stations, whereby the stopping times of wagons within the stations are respectively reduced. A furnace including more than two bending stations in succession involves the problem that the glass cools below the bending stations to such a degree that, by the time of its arrival below the final preheating station, the glass has a temperature which is colder than that of the glass thereabove to be preheated. Thus, the glass underneath cools the bottom glass of a pair of glasses thereabove to be preheated. The situation has been depicted in the accompanying fig. 1, which illustrates by way of example the cooling of glass on the lower track below bending stations 2.1, 2.2, 2.3.

An object of the invention is to provide a method and a furnace, capable of preventing the excessive cooling of glass prior to the arrival of glass below the final preheating block.

This object is achieved by a method of the invention, such that, after a bending operation, the mould-carrying wagon is transferred under one or more bending stations to a location directly below the first bending station or the final preheating station.

Thus, the glass does not have enough time for excessive cooling prior to its arrival below a final preheating block 1.5 but, instead, the cooling glass delivers heat to the glass being preheated in station 1.5.

The characterizing features of a bending furnace of the invention are set forth in the annexed claim 3.

The invention will now be described in more detail with reference made to the accompanying drawing, in which

fig. 1 shows a prior art bending furnace in a schematic axial and vertical section and

fig. 2 shows a bending furnace of the invention the same way as fig. 1.

the furnace includes a number of mould-carrying wagons 3, 4 on an upper track 1 and a second number of mould-carrying wagons on a lower track 2. The mould-carrying wagons are provided with an at least partially open floor 3 and a single end wall 4 for separating successive stations or blocks from each other, when the mould-carrying wagons 3, 4 are stationary. The upper track 1 is provided with a number of successive preheating stations 1.3, 1.4, 1.5 and more than two bending stations 2.1, 2.2, 2.3, 2.4. Below the upper track stations lies a number of cooling stations 3.1, 3.2, 3.3, 3.4. The upper track 1 and the lower track 2 are separated from each other by an insulated floor 9 extending across the bending stations 2.1, 2.2, 2.3.

Having been bent in the final bending station 2.4, a pair of glass sheets is descended by means of a hoist or lift onto the lower track 2, the wagon 3, 4 being carried therealong to a position directly below the first bending station 2.1. Alternatively, the wagon can even be shifted to a position directly below the final preheating station 1.5. During this transfer, the glass has not enough time for excessive cooling prior to its arrival below the final preheating station 1.5. In the present exemplary case, the glass in the final preheating station 1.5 has a temperature of 530°C and that of the cooling station therebelow is 555°C. These temperatures correlate well with the air temperature within the stations immediately after a transfer of wagons. Thus, warm air is flowing also within the domain of station 1.5 from lower track to upper track through the wagon floor or around its sides.

Transfer of the wagon 3, 4 from below the bending station 2.4 to below the bending station 2.1 is effected while the other wagons are stationary for creating preheating, bending and cooling stations. Thus, the total number of wagons is also reduced by 1-3 wagon, as the case may be. In order to enable a wagon transfer of the invention, the drive shaft for transfer rollers of wagons on the lower track 2 is divided into two shaft sections 5 and 6. A motor 8 is used for driving the shaft section 6 directly and the shaft section 5 through the intermediary of a clutch 7. A transfer of the invention is effected by driving the shaft 6 while the clutch 7 is open, at which time the shaft 5 is not rotating. When all wagons are carried over a single inter-station distance from one station to the next, the clutch 7 is closed and, thus, also the wagon located in the station 3.1 transfers into the station 3.2 as the motor 8 drives both shafts 5 and 6.

Thus, an arrangement of the invention is capable of achieving an intensified recovery of waste heat in a furnace with more than two bending stations. In addition, the glass cooling rate can be regulated below the bending stations 2.1 - 2.3 by adjusting the travelling speed of a wagon transfer. Yet another advantage is that a lift compartment located below the bending station 2.4 remains sufficiently cold for creating an edge stress for the glass as the cold air flows around the glass edges when descending the glass from the bending station onto the lower track.

Claims

1. **A method for transferring mould-carrying wagons** (3, 4) in a bending furnace for glass sheets, said furnace comprising preheating stations (1.3, 1.4, 1.5) and more than two bending stations (2.1, 2.2, 2.3, 2.4) in succession and therebelow a number of cooling stations (3.1, 3.2, 3.3, 3.4), a first number of mould-carrying wagons (3, 4) on an upper track (1) and a second number of mould-carrying wagons (3, 4) on a lower track (2), an end wall (4) of the mould-carrying wagons defining said preheating, bending and cooling stations when the mould-carrying wagons (3, 4) are stationary, **characterized** in that after a bending operation, the mould-carrying wagon (3, 4) is transferred under one or more bending stations (2.3, 2.2) to a location directly below the first bending station (2.1) or the final preheating station (1.5).
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2. A method as set forth in claim 1, **characterized** in that the transfer is effected while the other wagons (3, 4) are stationary in said preheating, bending and cooling stations.
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3. A bending furnace for glass sheets, comprising preheating stations (1.3, 1.4, 1.5) and more than two bending stations (2.1, 2.2, 2.3, 2.4) in succession and therebelow a number of cooling stations (3.1, 3.2, 3.3, 3.4), a first number of mould-carrying wagons (3, 4) on an upper track (1) and a second number of mould-carrying wagons (3, 4) on a lower track (2), an end wall (4) of the mould-carrying wagons defining said preheating, bending and cooling stations when the mould-carrying wagons (3, 4) are stationary, **characterized** in that after a bending operation, the mould-carrying wagon (3, 4) is adapted to be transferred under one or more bending stations (2.3, 2.2) to a location directly below the first bending station (2.1) or the final preheating station (1.5).
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4. A bending furnace as set forth in claim 3, **characterized** in that a transfer of the mould-carrying wagons (3, 4) along the lower track (2) is effected by providing two driving elements (5-8) operable independently of each other.
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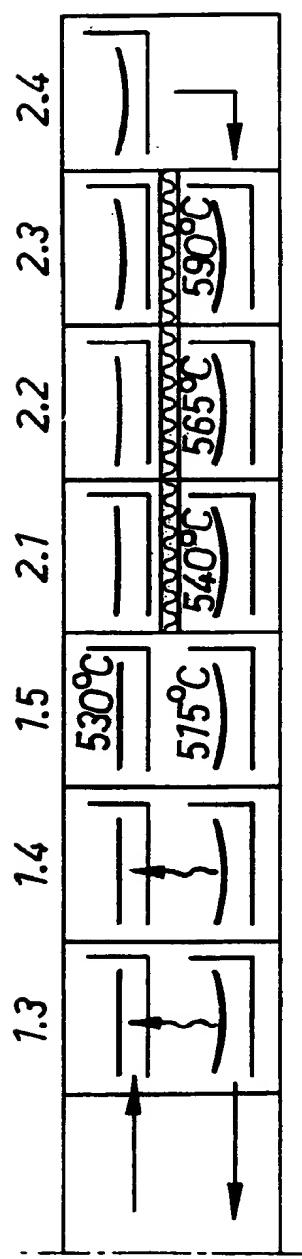


Fig. 1 (PRIOR ART)

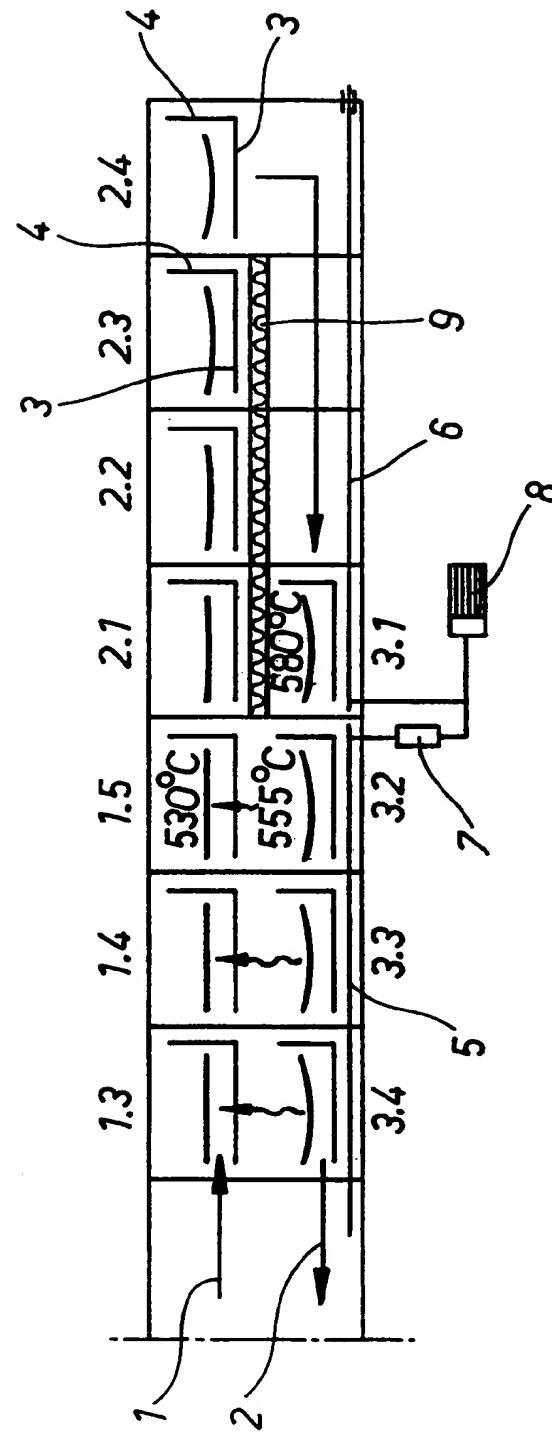


Fig. 2

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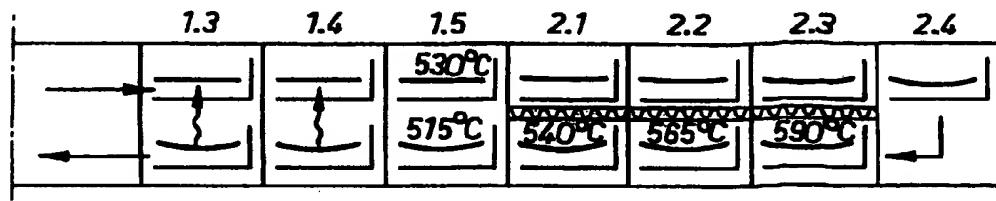


Fig. 1 (PRIOR ART)



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EUROPEAN SEARCH REPORT

Application Number
EP 96 10 3885

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	EP 0 370 313 A (TAMGLASS OY) 30 May 1990 * column 2, line 8 - line 30 * * claims; figure 1 * ----	1,3	C03B35/20 C03B23/025 C03B29/08 C03B27/044
P,A	EP 0 659 697 A (PILKINGTON GLASS LTD) 28 June 1995 * column 8, line 54 - column 9, line 39 * * claims; figure 1 * ----	1-4	
A	EP 0 132 701 A (KYRO OY ET AL) 13 February 1985 * claims; figures * & US 4 497 645 A -----	1-4	
D			
TECHNICAL FIELDS SEARCHED (Int.Cl.6)			
C03B			
<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Examiner	
BERLIN	11 December 1998	KUEHNE, H	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	